



Energy Storage Permitting, Interconnection, and Analysis

Emerson Reiter, NREL Project Lead
Tria Case, CUNY Director of Sustainability
Beth Chacon, Xcel Energy Director of Grid Storage and
Emerging Technology

**Distributed Generation
Interconnection
Collaborative (DGIC)**

April 5, 2017

Agenda

2017 DGIC News and Introductions

- Emerson Reiter, NREL

Solar + Storage Permitting and Interconnection in NYC

- Tria Case, Director of Sustainability, City University of New York (CUNY)


Utility Guidance for Energy Storage Interconnection

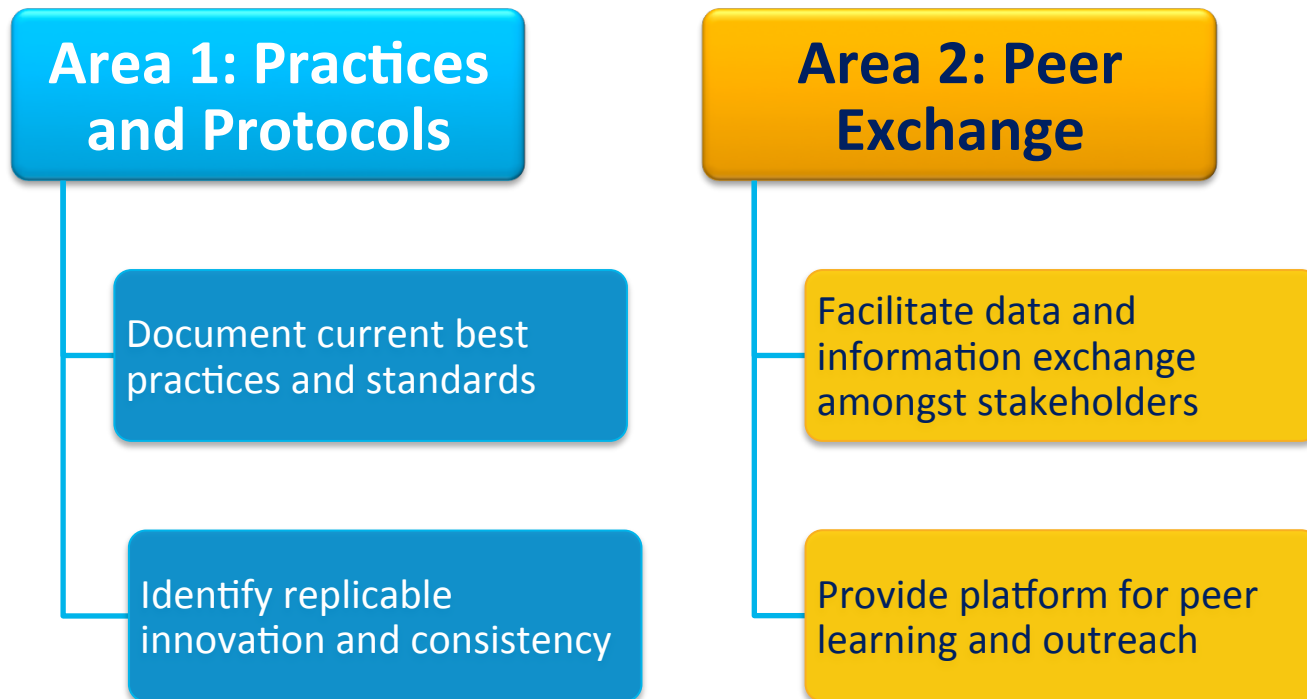
- Beth Chacon, Director of Grid Storage and Emerging Technology, Xcel Energy

Question & Answer

DGIC Background

Distributed Generation Interconnection Collaborative (DGIC)

- Supported by the U.S. DOE SunShot initiative 
- Launched following a stakeholder workshop in Oct 2013
- 16 webinars conducted to date



DGIC Planned 2017 Activities

Area 1: Practices and Protocols

Develop case studies on leading interconnection practices based on peer nomination

Execute data analysis on pre-application reporting for interconnection applicants

Curate and share cutting-edge DG research from DOE programs

Area 2: Peer Exchange

Published “lessons learned” on community solar for municipal utilities

DGIC blog posts

New DGIC Website:
www.nrel.gov/dgic

4 webinars with utility & industry experts

New Website: www.nrel.gov/dgic



Distributed Generation Interconnection Collaborative



Established in 2013, Distributed Generation Interconnection Collaborative (DGIC) provides a forum for the exchange of best

[Register for Upcoming Webinar](#)

New Website: www.nrel.gov/dgic

Data Transparency

As distributed PV systems are deployed more broadly in the United States, the availability of key data will only become more important and beneficial.

Business Models and Regulation

The growing role of distributed resources in the electricity system is leading to a shift in business models and regulation for electric utilities.

Application Processing

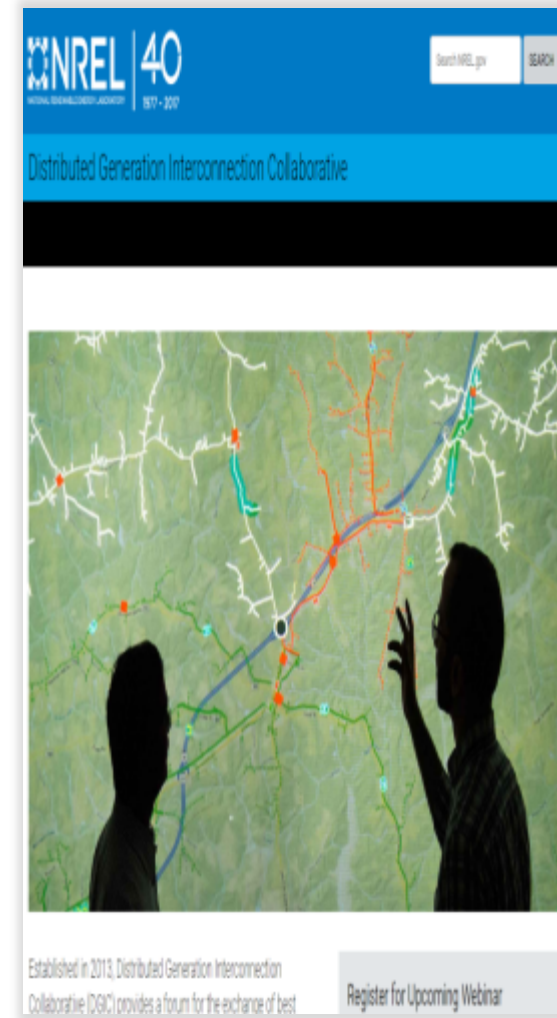
Several utilities that experienced a drastic rise in applications have taken innovative business and technical steps to speed processing, reduce paperwork, and improve customer service.

Analytical Methods for Interconnection

Many utilities and jurisdictions are seeking the right screening and analytical methods and tools to meet their reliability mandates and customer service goals.

Technology Solutions

Utilities and other stakeholders have become increasingly concerned about the resulting impacts on grid reliability.



Nominate your Peers for Case Studies

- This year, DGIC will extend peer exchange beyond the webinar format by producing a series of case studies on leading practices in distributed generation interconnection
- Do you know of an organization doing high-quality, innovative work on the interconnection of distributed generation? Can you help us identify industry leaders?

If so, PLEASE NOMINATE!

- NREL will document their best practices, producing case studies to be posted to the DGIC website
- Go to: <https://www.nrel.gov/dgic/nominate.html> to nominate by **April 30, 2017**.

2017 DGIC Webinars

April 5, 2017 (today)

Energy Storage Permitting, Interconnection and Analysis

May 18, 2017

Distributed Solar for Small Utilities

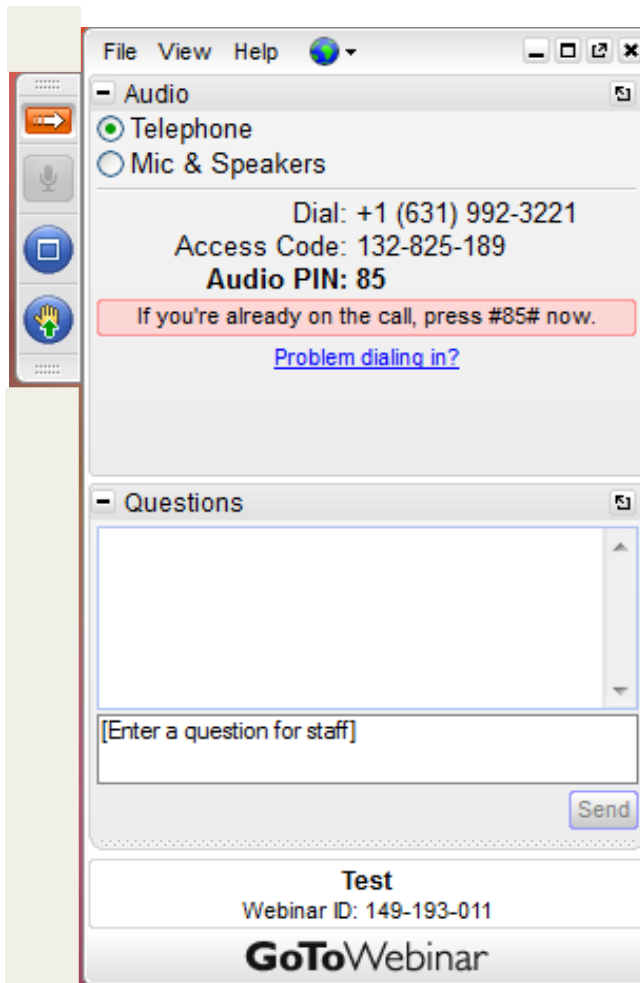
July 19, 2017

Plug and Play Solar

September, 2017

Aggregation of Distributed Energy Resources

Logistics



Participants are joined in listen-only mode.

← Use the Q&A panel to ask questions during the webinar.

← To ask a question: Type your question in the Q&A GoToWebinar toolbar.

The webinar is being recorded and will be posted on the DGIC site:
<http://www.nrel.gov/dgic.html>

Recent Research into Energy Storage



Installed Cost Benchmarks and Deployment Barriers for Residential Solar Photovoltaics with Energy Storage: Q1 2016

Kristen Ardani,¹ Eric O'Shaughnessy,¹ Ran Fu,¹
Chris McClurg,² Joshua Huneycutt,³ and
Robert Margolis¹

¹ National Renewable Energy Laboratory

² Rocky Mountain Institute

³ U.S. Department of Energy

NREL is a national laboratory of the U.S. Department of Energy
Office of Energy Efficiency & Renewable Energy
Operated by the Alliance for Sustainable Energy, LLC

This report is available at no cost from the National Renewable Energy
Laboratory (NREL) at www.nrel.gov/publications.

Technical Report
NREL/TP-7A40-67474
February 2017

Contract No. DE-AC36-08GO28308

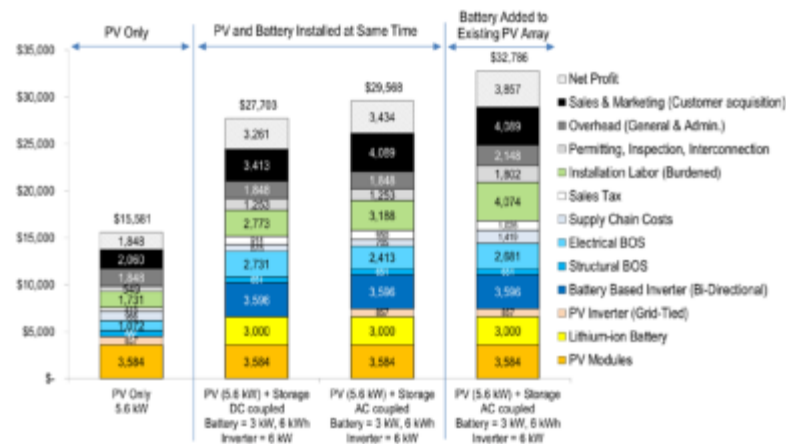
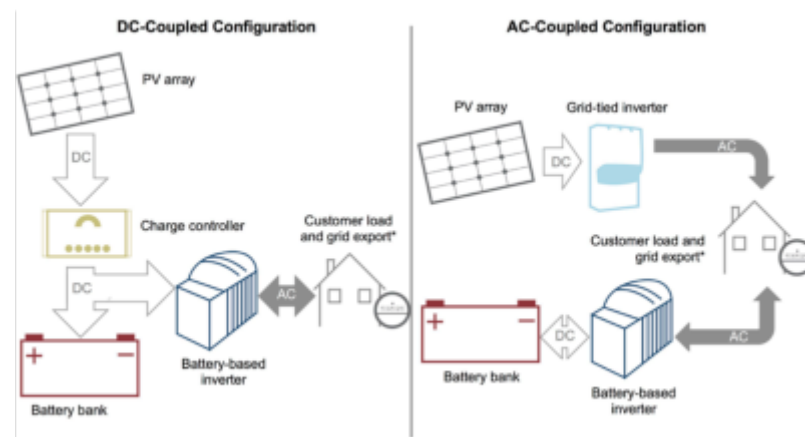


Figure ES-1. Modeled total installed cost and price components for residential PV-plus-storage systems, small-battery case (2016 U.S. dollars)

Available at: <http://www.nrel.gov/docs/fy17osti/67474.pdf>

Today's Webinar: Energy Storage Permitting, Interconnection and Analysis



Tria Case
Director of Sustainability
and
Energy Conservation
City University of New York (CUNY)
Tria.Case@cuny.edu

On Solar + Storage
Permitting and
Interconnection in NYC



Beth Chacon
Director of Grid Storage & Emerging Technology
XCEL Energy
Colorado
beth.j.chacon@xcelenergy.com

On Utility Guidance for
Energy Storage
Interconnection



Emerson Reiter
Project Lead
NREL

<http://www.nrel.gov/dgic>

Webinar slides and recordings available here!

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National Renewable Energy Laboratory

Distributed Generation Interconnection Collaborative

April 5, 2017

Energy Storage Permitting, Interconnection, and Analysis

Tria Case

University Director of Sustainability and Energy Conservation

City University of New York

Sustainable CUNY- An Objective Platform



Solar Infrastructure

- Permitting
- Zoning
- Grid Analysis
- Policy Support
- Installer Roundtable



Mapping the Way

- One stop Portal
- Solar Maps
- Data Analytics
- Roadmaps



Accessing Solar

- Group Purchasing
- Community Shared Solar
- Education
- NY Solar Summit



Resiliency

- Smart DG Hub
- Solar-plus-storage
- Critical Facility Support

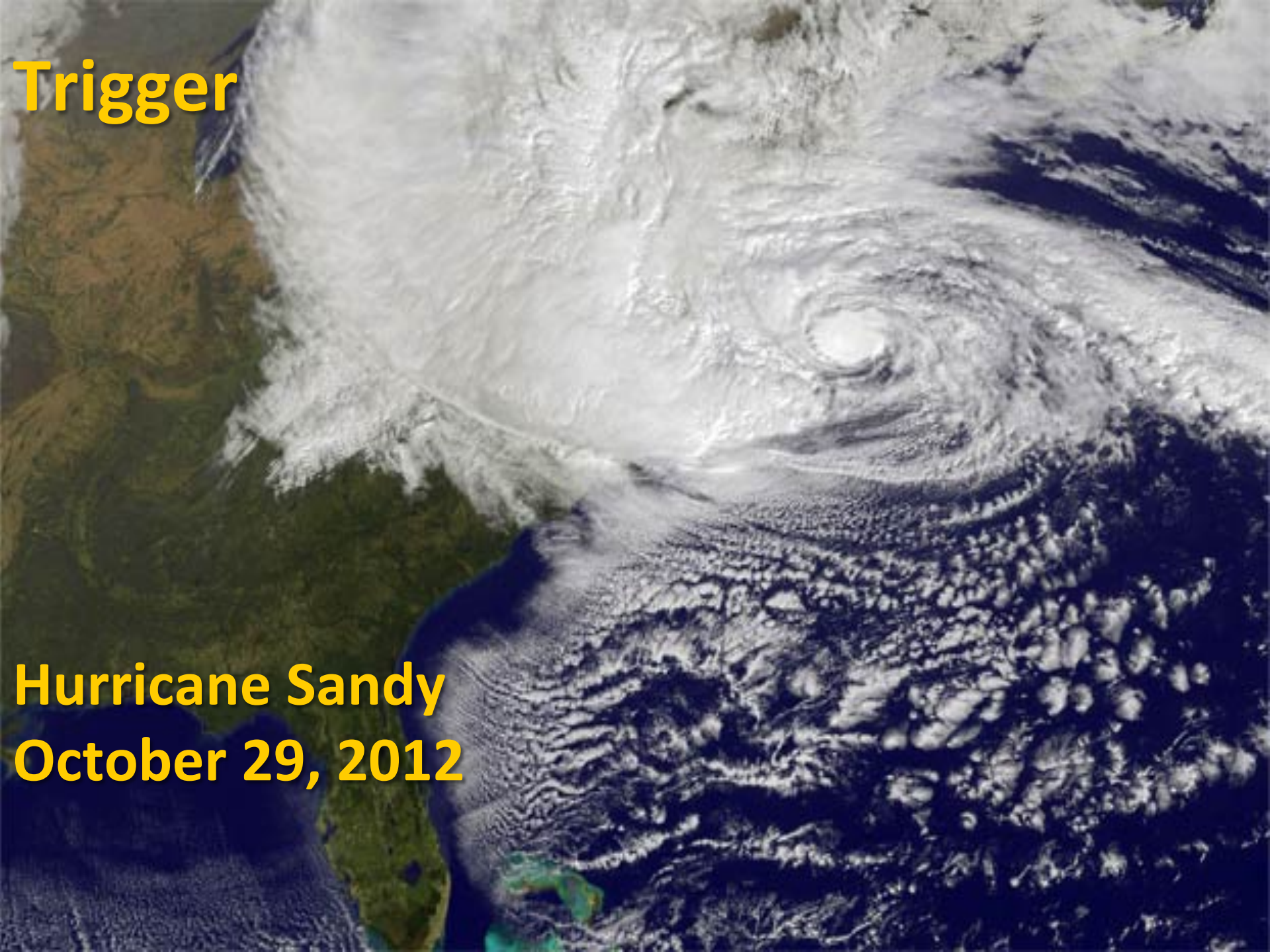
Challenge

An aerial photograph showing a winding, light-colored road or path that snakes up a steep, densely forested mountain slope. The road is a series of sharp, tight turns, creating a zig-zag pattern as it ascends. The surrounding vegetation is lush green, and the overall scene conveys a sense of a challenging and rugged environment.

**Build and stabilize an
emerging energy sector in
changing environments**

Trigger

**Hurricane Sandy
October 29, 2012**







Hardware Technologies

Policy & Legal

**Smart DG
Hub**

**Software
Technologies**

**Economics &
Finance**

Smart DG Hub- Resilient Solar Project



NY SOLAR MAP

[Going Solar](#)

[Installing Solar](#)

[Financing Solar](#)

[Solar+Storage](#)

[Resources](#)

[NYC Solar](#)

[About](#)

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Resources for the Current Process for Installing Solar+Storage



The Energy Storage Systems Permitting and Interconnection Process Guide for New York City

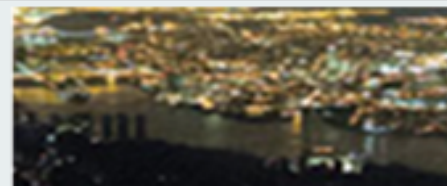
Economics and Finance of Solar+Storage Fact Sheet

Guidance Memo for Including Storage in Community Solarize Programs

NYC Solar+Storage Glossary

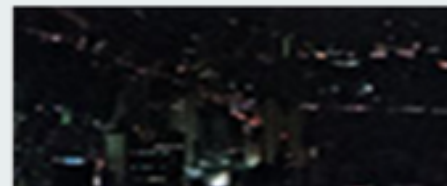
Resilient Solar PV Systems Hardware Fact Sheet

Economic and Resiliency Impact of PV and Storage on New York Critical Infrastructure

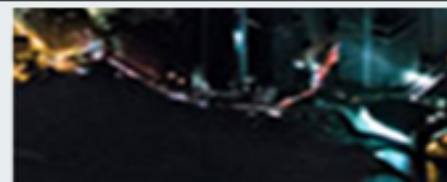
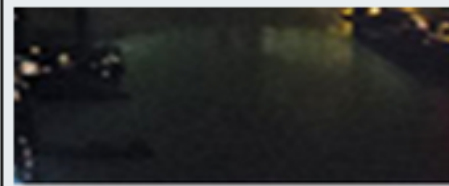
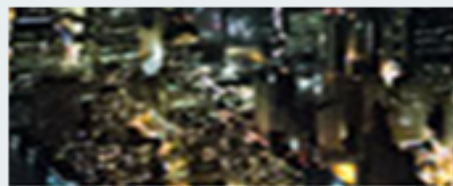


Solar+Storage and Microgrid Communications Fact Sheet

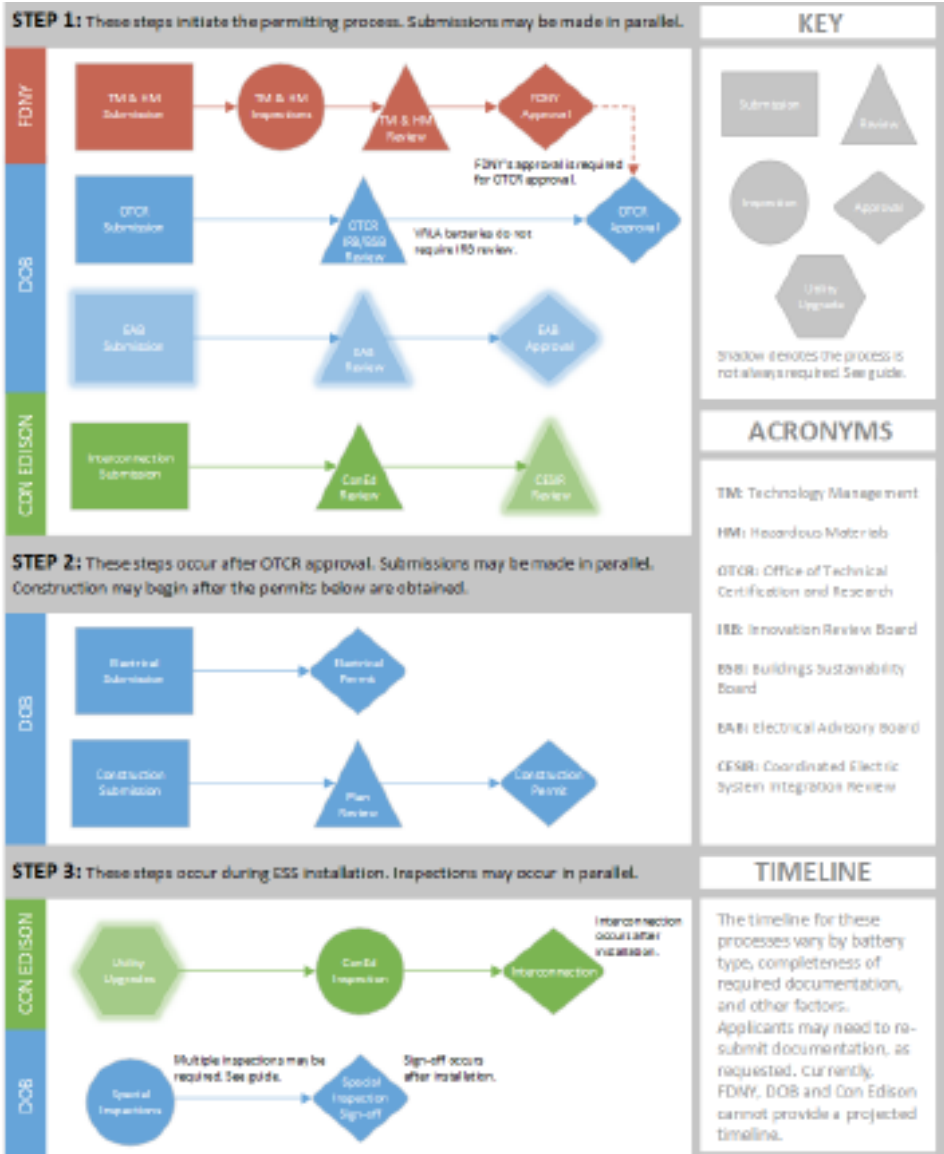
Solar and Storage Cost Survey



Solar+Storage Retrofit Guidelines



Sample of the Process Guide for Permitting and Interconnection- VRLA



FDNY



DOB



Con Edison



A Roadmap to Resilient Solar In New York



Develop a sustainable market through better policy



Compensate resilient PV for the services it provides to the grid



Create incentives to value the improved resiliency of sites with resilient PV



Provide education and outreach about resilient PV systems and their benefits to installers and consumers



Hardware

- Core Components
- AC vs. DC-coupling
- Case Study: Emerging Storage Use Cases
- Case Study: Modeling resilient PV
- Barriers & Solutions
- Practitioner experience

Policy

- Regional activities and opportunities
- Case Study: MA Peak demand reduction
- Case Study: Con Ed/NYSERDA Support for NYC's Storage Market
- Barriers & Solutions
 - Permitting processes

NYSOLAR SMART DG Hub
New York City Resilient Solar Roadmap
March 2017

Software

- Use cases and applications
- Case Study: Interoperability Retrofits
- Barriers & Solutions
- Customer data availability



Economics

- Improving the economics
- Cost survey
- Case Study: Ca/Germany incentives
- Case Study: NYSolar map resiliency calculator
- Barriers & Solutions
- High project costs

NY Solar Map and Portal



NY SOLAR MAP

[Going Solar](#)

[Installing Solar](#)

[Financing Solar](#)

[Solar+Storage](#)

[Resources](#)

[NYC Solar](#)

[About](#)

[Help](#)

Find Your Solar Potential

→ Enter your address

or jump to

New York State

Which best describes you?

- ☐ Residential ☐ Commercial
☐ Installer ☐ Municipal / Non-profit

Available map layers

Installed Capacity

> Add your system to the map



Solar
Statistics

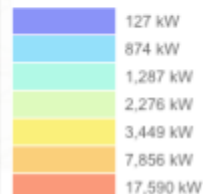


Calculator In Your Area



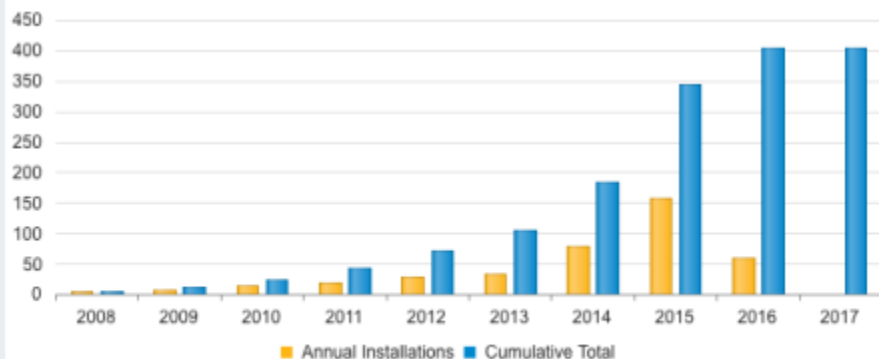
Advanced
Tools

Installed Capacity

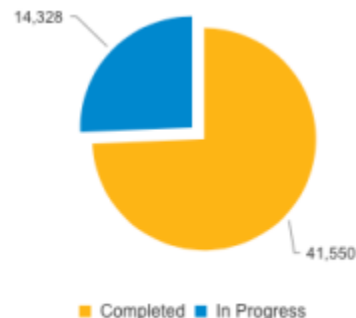


Solar Statistics for New York State

Installed Solar Power Generation Capacity (Megawatts)



Status of Solar Projects



Smart DG Hub- Resilient Solar Project



NY SOLAR MAP

Going Solar- Installing Solar- Financing Solar- Solar+Storage Resources- NYC Solar-

Find Your Solar Potential

➔ Enter your address

Queens

Which best describes you?

☒ Residential

☐ Commercial

☐ Installer

☐ Municipal / Non-profit

Available map layers

NYC Installed Energy Storage Systems

> Add your system to the map

Solar Statistics

Calculator

In Your Area

Advanced Tools

Palisades Park

Fort Lee

Ridgely

Edgewater

Br

Hutchinson

College Point

Whitestone

Bayside

Flushing

East Elmhurst

Jackson Heights

Elmhurst

Forest Hills

Hollis

St Albans

Spring Garden

South Ozone Park

Joan F Kennedy Intl Airport

Howard Beach

Richmond Hill

South Richmond Hill

Ozone Park

Brooklyn

Manhattan

Manhattan Island

Long Island City

Sunnyside

Maspeth

Middle Village

Ridgewood

Liberty State Park

Hoboken

Union City

West New York

Cliffside Park

Eatview

Palisades Park

Fort Lee

Ridgely

Edgewater

Br

Hutchinson

College Point

Whitestone

Bayside

Flushing

East Elmhurst

Jackson Heights

Elmhurst

Forest Hills

Hollis

St Albans

Spring Garden

South Ozone Park

Joan F Kennedy Intl Airport

Howard Beach

Richmond Hill

South Richmond Hill

Ozone Park

Brooklyn

Manhattan

Manhattan Island

Long Island City

Sunnyside

Maspeth

Middle Village

Ridgewood

Liberty State Park

Hoboken

Union City

West New York

Cliffside Park

Eatview

+

-

Legend

Solar Calculator



NY SOLAR MAP [Going Solar](#) · [Installing Solar](#) · [Financing Solar](#) · [Solar+Storage](#) · [Resources](#) · [NYC Solar](#) · [About](#) · [Help](#)

Solar Potential Calculator

1. Solar System Assumptions

Building / User Type ⓘ Residential

Approx. Monthly Electric Bill ⓘ \$290.00

Financing Type ⓘ

Cash

Loan

Lease

PPA

Cash

RESET

* financing options can change you below) to adjust payment type.

[+ Open Advanced Assumptions](#)

2. Output

20 456 Main Street

Optimal System Size (kW DC) 6.97
(697 square feet out of 697 usable square feet)

Payback Period 8 years

Annual Savings \$2,505

Out-of-Pocket Cost \$27,941

Net Cost After Incentives & Taxes \$15,809

[GET A QUOTE](#)

[DOWNLOAD REPORT](#)

[- Close Cost Details](#)

Cost Breakdown

Sticker Price of Solar System (Before Incentives) ⓘ	\$32,123
Out-of-Pocket Cost ⓘ	\$27,941
Inverter Replacement Cost ⓘ	\$2,091
Operations and Maintenance Costs ⓘ	\$0

Incentives

NY-Sun Incentive ⓘ	\$4,182
Federal Investment Tax Credit ⓘ	\$8,382
New York State Tax Credit ⓘ	\$5,000
Accelerated Depreciation (MACRS) ⓘ	\$0
NYC Property Tax Abatement ⓘ	\$0

Taxes

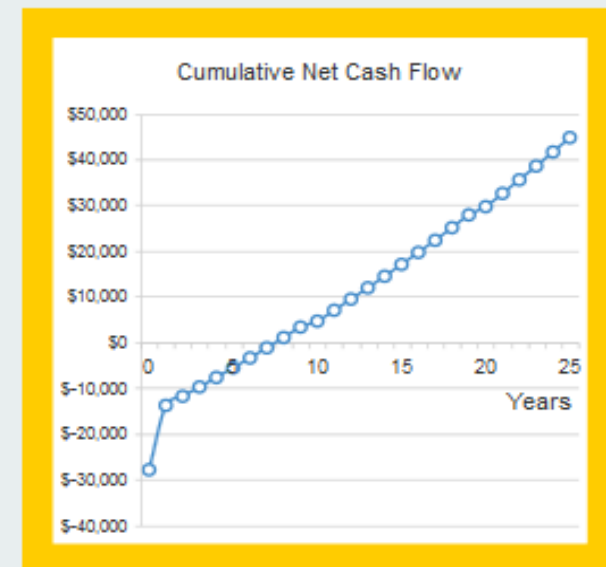
Federal Taxes Due on State Incentives/Credits ⓘ	\$1,250
Federal Taxes Due on City Incentives/Credits ⓘ	\$0

Financial Metrics

Charts

[<<Previous](#)

[Next>>](#)



[+ Open Financing and System Details](#)

Reducing Distributed Energy Storage Soft Costs

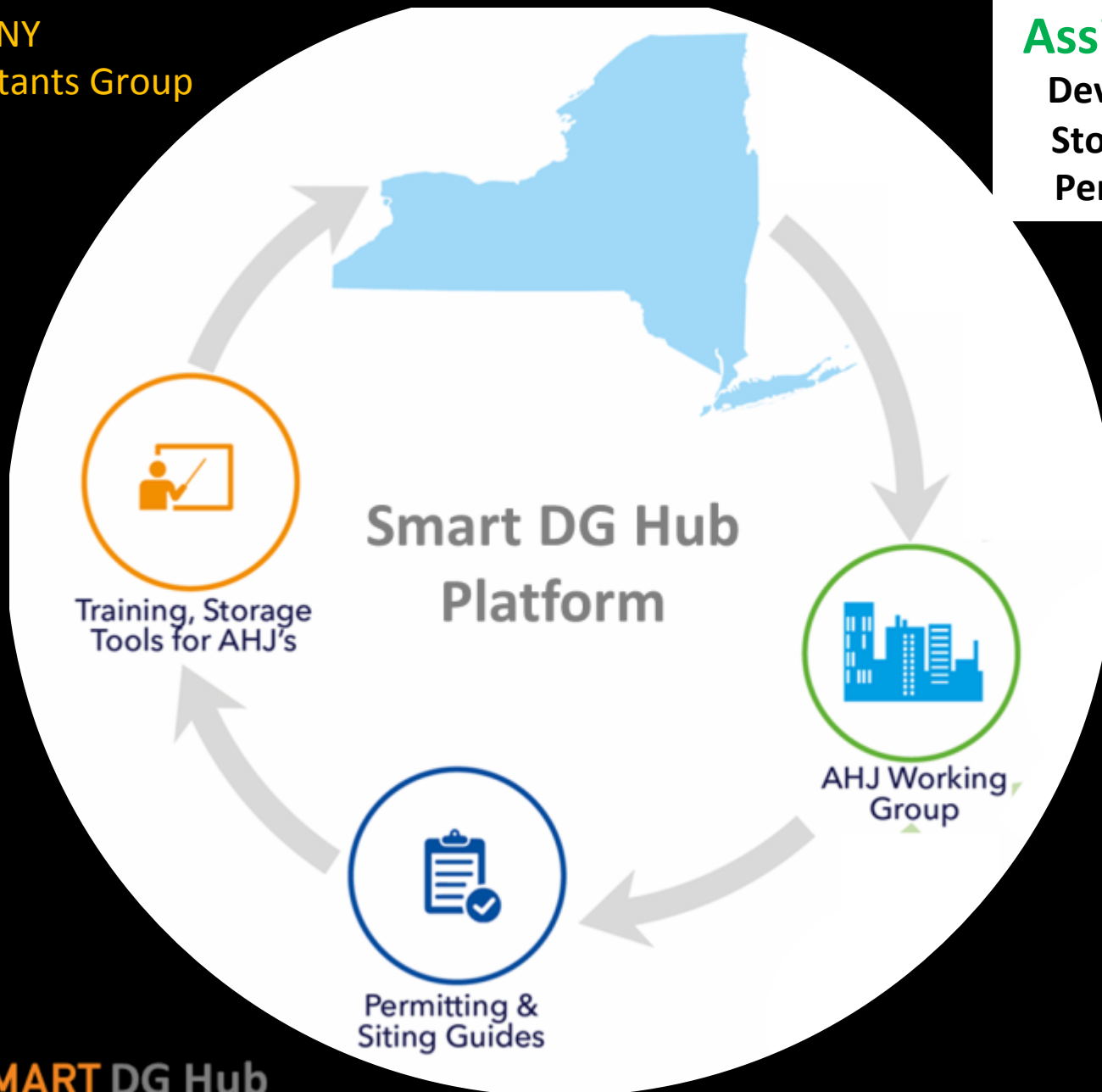


Smart DG Hub- Reducing Soft Costs



Sustainable CUNY
Meister Consultants Group
DNV-GL

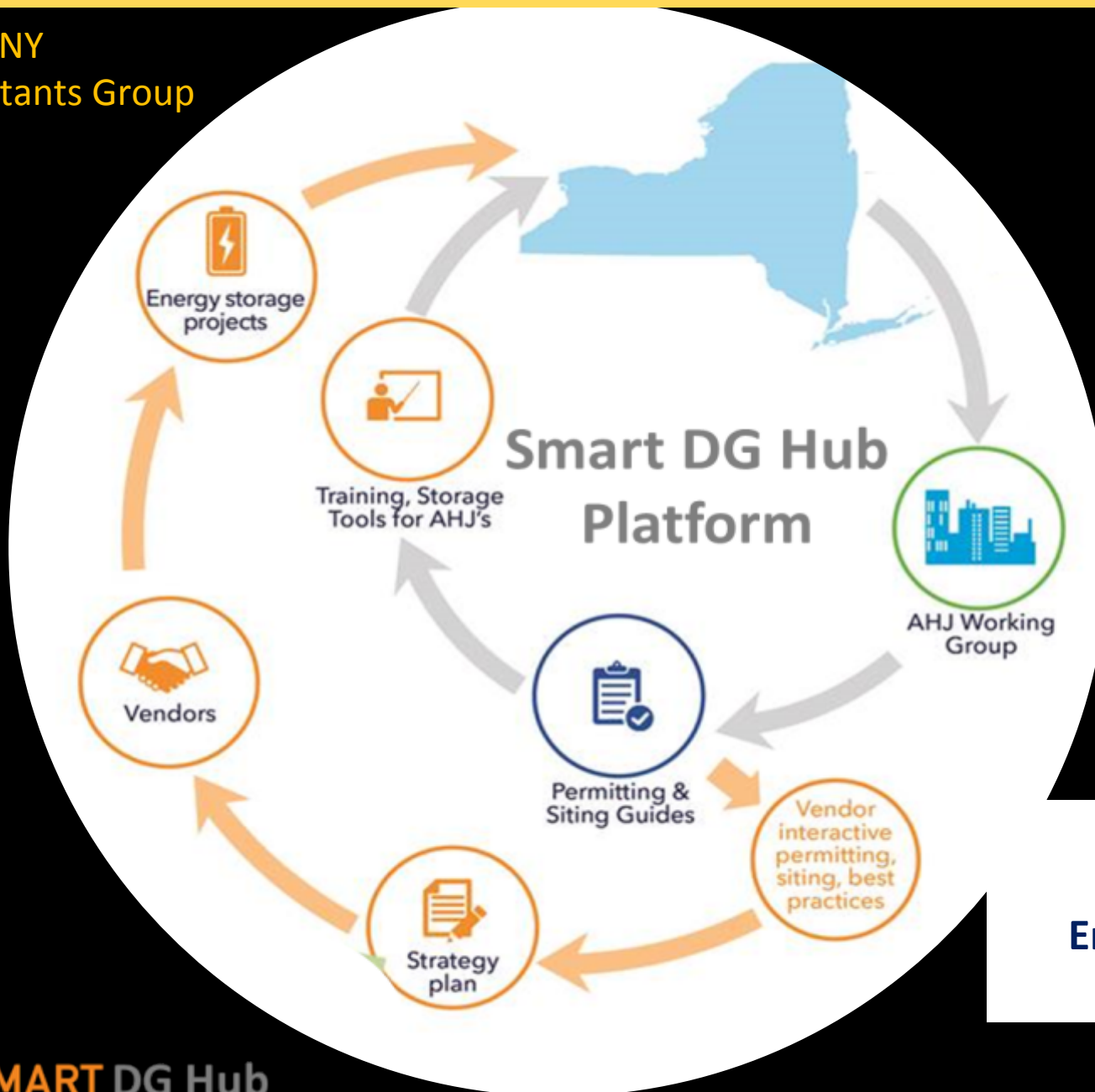
Assist AHJs with
Developing Model
Storage Siting and
Permitting Guides



Smart DG Hub- Reducing Soft Costs



Sustainable CUNY
Meister Consultants Group
DNV-GL



**Best Practices
Guidance for
Energy Storage
Vendors**

FDNY ESS Collaboration





NEW YORK **SOLAR** + *Storage* **SUMMIT**

June 21, 2017

City University of New York
John Jay College, NY, NY



nysolarmap.com

nysolar@cuny.edu



Beth Chacon
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**On Utility Guidance for
Energy Storage
Interconnection**

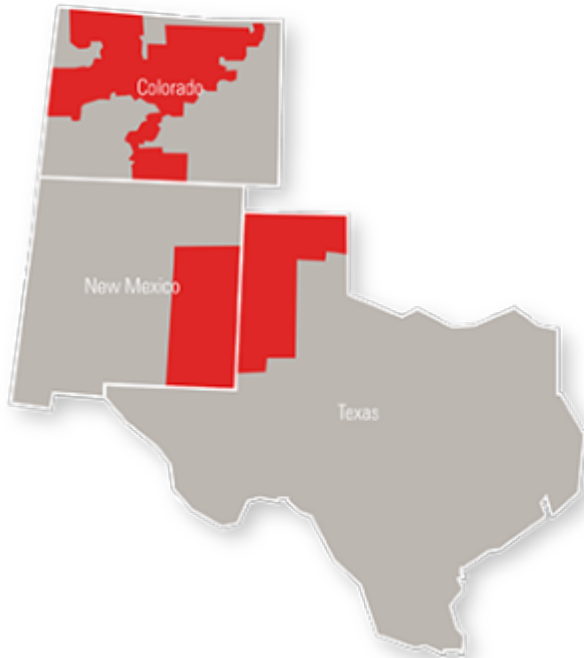
<http://www.nrel.gov/dgic>

Webinar slides and recordings available here!



Energy Storage Interconnection Update Beth Chacon, Xcel Energy

ABOUT XCEL ENERGY



3.5 million electricity and 2 million natural gas customers in 8 states

- No. 1 utility wind provider for 12 years (AWEA)
- Climate Leadership Award for GHG reductions (EPA)
- Founding member of EPA's Methane Challenge

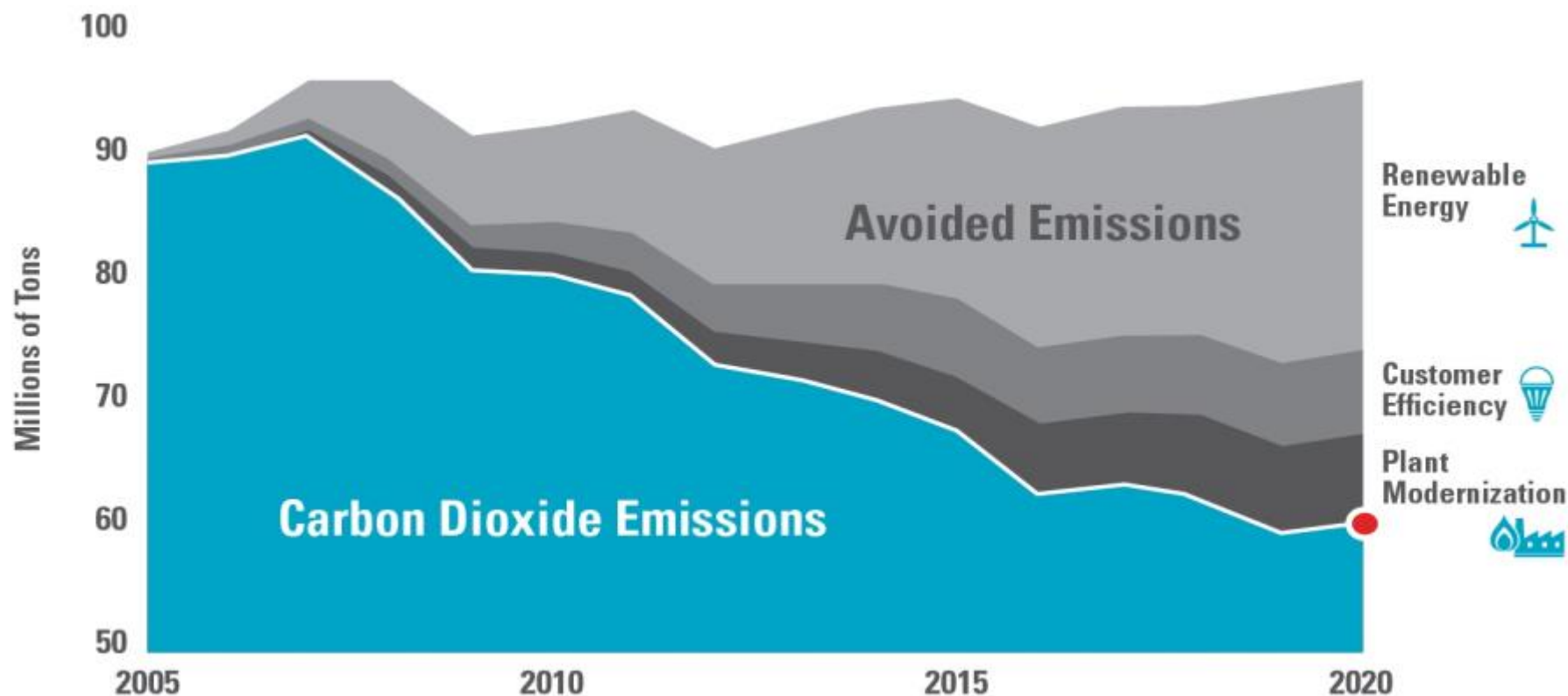
OUR CLEAN ENERGY STRATEGY



Carbon reductions at a reasonable cost:

24% reduction in CO₂ since 2005

30% reduction expected by 2020



NEW BATTERY INTERCONNECTION GUIDELINES



- Focused on Colorado
- Worked with Industry
- Filed Tariff in January
- Link to guidelines on website:
 - “How to interconnect battery guidance”
 - Search Xcel Energy energy storage guidance (No. 1, No. 2 and No. 3)



INTERCONNECTION CONFIGURATIONS



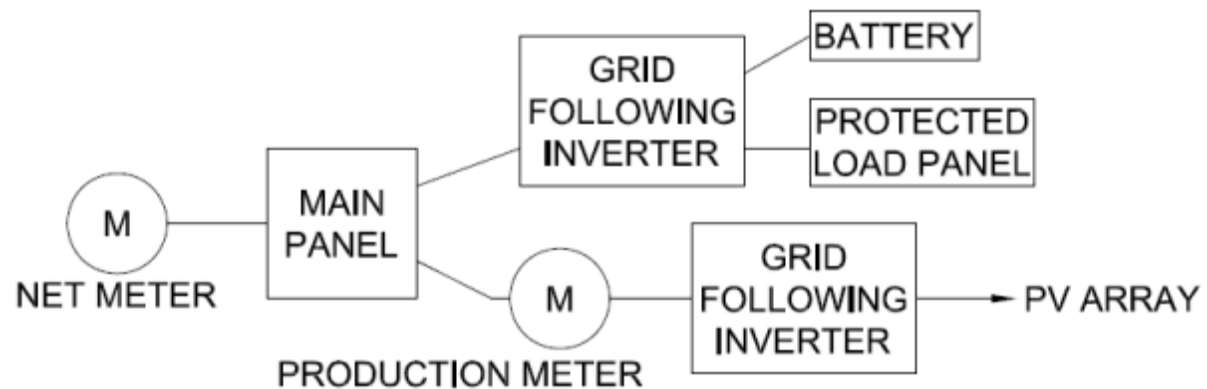
- Energy Storage Standby applications:
 - Interconnection agreement not required
 - Interconnection review required
 - Must meet NEC 702



PARALLEL APPLICATIONS



- Case 1: Battery charged solely by renewable energy
 - Energy Storage can export to the grid
- Case 2: Battery charged by grid energy
 - Energy Storage can not discharge to the grid
- All parallel-grid cases:
 - Interconnection Review and Agreement required
 - Inadvertent export ok

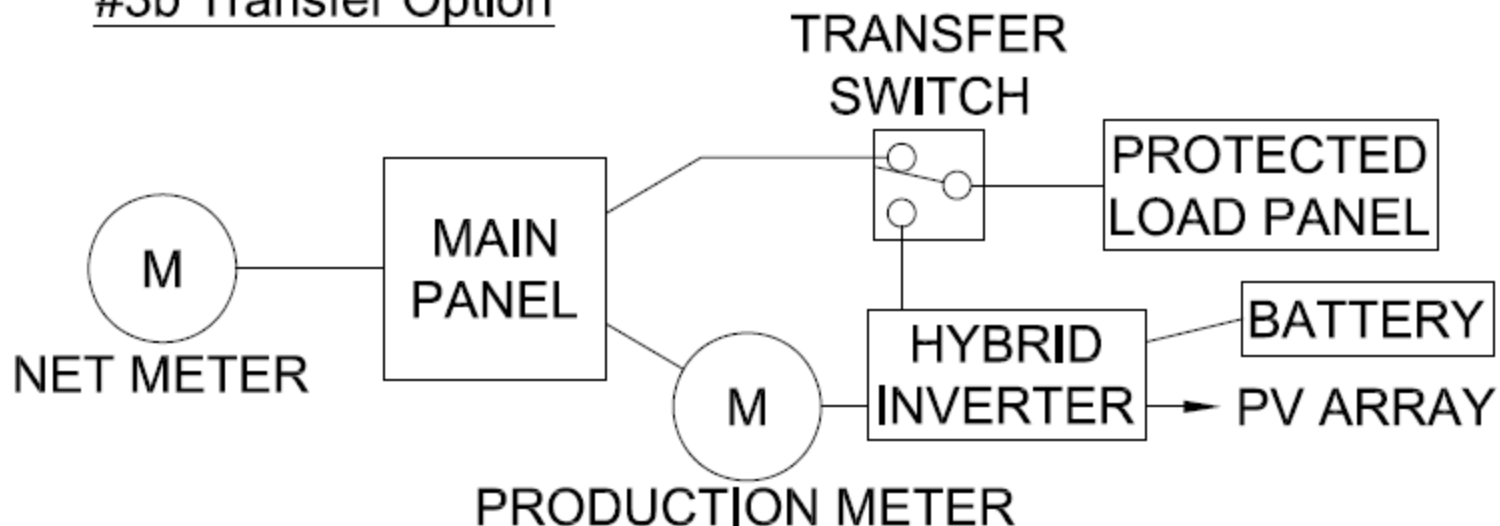


HYBRID INVERTER APPLICATIONS



One of two Configurations:

#3b Transfer Option

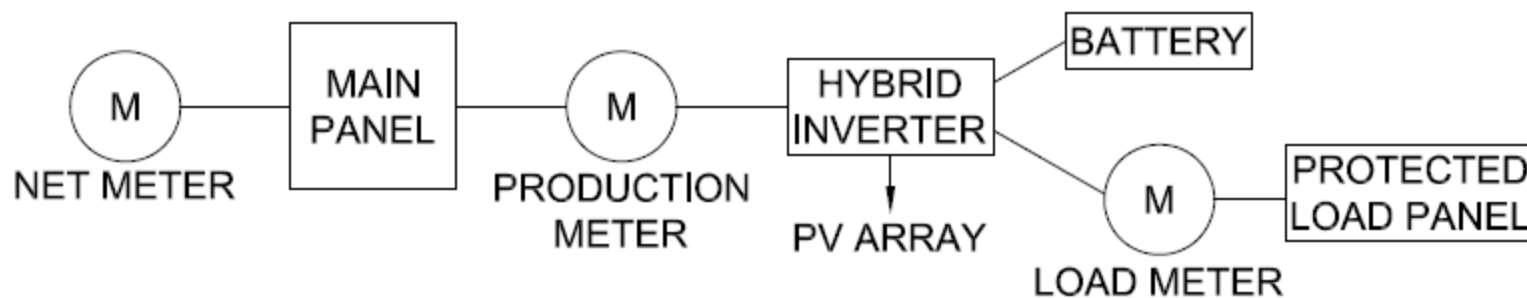


HYBRID INVERTER APPLICATIONS



- Requires additional load meter

#3a Meter Option



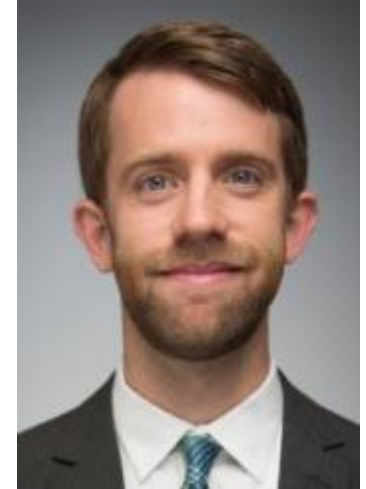
Questions



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- **Shape the discussion and sign up for DGIC alerts:**
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